DISTRIBUTOR ELEMENT FOR LUBRICATING INSTALLATIONS

The invention concerns a distributor element, particularly a feed distributor, for metering lubricants like grease for lubricating installations.

A known lubricant distributor of this type features a valve piston with a bore, which valve piston moves under the lubricant pressure operating at a lubricant inlet against the force of a single return spring from a starting position in which the bore releases a connection via a connection passage from a metering chamber to a dispensing chamber, to a metering position in which the valve piston releases a passage from the lubricant inlet to the connecting passage and therefore to the metering chamber. Additionally, this lubricant distributor has a dispensing piston which can be moved against the force of the said only return spring under the effect of lubricant entering the metering chamber. As a result of the lubricant pressure building up in the metering chamber, the lubricant volume present in the dispensing chamber between the valve piston and the dispensing piston is pushed into at least one lubricant outlet and the valve piston is moved by the dispensing piston into an intermediate position until pressure equalisation has occurred, in which position the valve piston blocks the passage from the lubricant inlet to the connecting passage and therefore to the metering chamber. Upon a subsequent pressure relief at the lubricant inlet the valve piston and also the dispensing piston are returned to their starting position by the only return spring. A disadvantage of such a distributor element is that the hydraulic lubricant pressure (working pressure) of e.g. up to 250 bar operating at the valve inlet must be reduced to a

relatively low residual pressure of e.g. about 45 bar for the required pressure relief to ensure reliable operation.

The known design, in particular if several lubricant distributors are connected in series, can lead to impaired functioning of the last lubricant distributor because of pressure reduction occurring in the lubricant line. The problem of a too low relief pressure cannot be solved by strengthening the only return spring provided in this state of the art, because this does not only cooperate with the valve piston but in the other direction also with the dispensing piston. A stronger return spring would lead to an increase of the pressure which must move the dispensing piston into its final position.

The purpose of the present invention is to propose a distributor element of the type described in which the relief pressure (residual pressure) is significantly higher e.g. about twice as high as with the known distributor element and yet without an increase of the minimum operating pressure i.e. the pressure at which the dispensing piston is in its displaced final position.

The invention essentially achieves this purpose with a distributor element for metering of lubricants like grease, for lubricating installations, featuring a valve piston with a bore which valve piston moves under the pressure of a lubricant operating at a lubricant inlet against the force of a first return spring from a starting position in which the bore releases a connection between a dispensing chamber and a metering chamber via a connecting passage to a metering position in which the valve piston releases a passage from the lubricant inlet to the connecting passage and therefore the metering chamber.

Additionally the invention proposes a dispensing piston which under the effect of lubricant entering the metering chamber moves against the force of a second return spring so that the lubricant volume present in the dispensing chamber between the valve piston and the dispensing piston is pushed into at least one lubricant outlet. The valve piston may also be moved into an intermediate position until pressure equalisation has occurred, in which position the valve piston blocks the passage from the lubricant inlet to the connecting passage and therefore to the metering chamber. Upon pressure relief at the lubricant inlet the valve piston is moved back to its starting position by the first return spring and the dispensing piston is moved back to its starting position by the second return spring.

Because of the higher residual pressure proposed by the invention, shorter switching times are achieved and lines of greater length and/or smaller diameter can be used which saves costs. At the same time the minimum operating pressure can be kept low. Spring force and spring characteristics of the two return springs can be separately dimensioned as a function of the diameter of the pistons, bores and passages.

As we have seen in comparison to the state of the art, the invention proposes that the only return spring be replaced by two separately functioning return springs. Now the first return spring only works together with the valve piston, whereas the second spring only takes care of the return of the dispensing piston. The dimensioning of the return springs can follow depending on the available conditions e.g. as a function of the length and diameter of the lines used, metering volumes, operating pressures, residual pressures and the like.

Thus it becomes possible to achieve in a simple manner that the minimum operating pressure is not increased but can be kept low despite the increase in the residual pressure.

In a constructionally particularly simple manner the solution as per the invention can be realised in an embodiment by the fact that an essentially hollow cylindrical supporting body for both return springs is arranged between the first and second return spring. The passage that may be present in the supporting body permits an extension of the dispensing piston facing the valve piston so that when the dispensing piston is actuated by the pressure built up in the metering chamber, the valve piston can first be moved by the dispensing piston into an intermediate position in relation to its starting position in which the lubricant inlet is separated from the connecting passage.

In a further embodiment of the invention the valve piston, dispensing piston, supporting body and the two return springs are arranged in a mutually axial configuration in a common straight passage of a valve housing In order to simplify the manufacture and improve the functionality.

Advantageously, in order to save space and provide reliable support, the second return spring is a spiral coiled spring mounted around the dispensing piston.

In another embodiment of the invention the fact that the second return spring, being a spiral coiled spring, is in any case with the end that faces the valve

piston, mounted around the first return spring which is also a spiral coiled spring, achieves that at a specified length of the return springs the total length of the distributor element can be short.

In this situation it is advantageous if the first return spring being a spiral coiled spring is housed with the end that faces the dispensing piston in a cylindrical supporting body which is surrounded by the second return spring which is also a spiral coiled spring. The first return spring can then be braced on a radially inward projecting flange at the end of the cylindrical supporting body opposite the valve piston and is accommodated in the cylindrical supporting body. Conversely the second return spring can rest against the outside of the cylindrical supporting body and be braced on a radially outward projecting bottom flange of the cylindrical supporting body.

The supporting body itself can rest against a bearing shoulder of the valve housing facing away from the valve piston.

Further purposes, features, advantages and application possibilities of the invention become clear from the following description of embodiments with reference to the drawings. Hereby all features described and/or graphically displayed, individually or in any combination, are the subject of the invention, also independent of their being summarised in individual claims or their cross-reference.

Fig. 1 Partial section through the longitudinal centre plane of a valve element designed as a feed distributor as proposed by the invention in accordance with an embodiment.

Fig. 1A — Side view of the dispensing piston taken from Fig. 1.

Fig. $1B_1$ — Side view and top view of the supporting body taken from Fig. 1

and

$1B_2$ — Representation as per Fig. 1 of another embodiment of a distributor element as per invention and

Fig. 2 — Representation of the detail IIA from Fig. 2

Fig. 2A

The feed distributor for metering lubricants e.g. grease shown in the drawings for feed lubricating installations has a distributor housing 14 with a passage 13 extending over the length of the housing 14. In the lower end of the housing 14 a sealing element 16 with a lubricant inlet 6 is screwed in. The lubricant inlet 6 opens on to an axial inlet passage 6' that leads to valve piston 1. This valve piston is axially displaceable in the passage 13 and is braced on the side opposite the lubricant inlet 6 on the first return spring 7 which is coaxially arranged in the passage 13. The first return spring 7 rests with its end that is opposite the valve piston 1 against a hollow cylindrical supporting body 12 which is axially fixed in a defined position in the passage 13 by means of threaded connection 17 and bearing shoulder 22.

In Fig. 1 the valve piston 1 is in its intended starting position at the beginning of a lubricating cycle, which position the valve piston 1 reaches at the end of the preceding lubricating cycle and in a lubricating interval that may follow. In the embodiment shown the valve piston 1 has a transverse bore 2 which on one side communicates via an axial bore section with a dispensing chamber 3 in the passage 13 before the valve piston 1 and on the other side via a radial bore section with a passage 8 radially aligned in the valve housing 14 and

whereby this passage 8 leads into a connecting passage 5 longitudinally extending parallel to the connecting passage 3.

The connecting passage 5 leads at its upper end i.e. the end opposite the valve piston 1 into a metering chamber 4 which inside the passage 13 is delimited in relation to the valve piston 1 by a dispensing piston 9 equipped with a peripheral seal 17. The dispensing piston 9 is braced towards the valve piston 1 by means of a second return spring 10 on the side of the supporting body 12 opposite the valve piston 1.

In the starting position shown in Fig. 1 the dispensing piston 9 may extend into an upper laterally open sealing body with a check pin for visual function display. Towards the valve piston 1 the dispensing piston 9 may have an extension 20 to enable the valve piston 1 to first move into an intermediate position at the end of the lubricating cycle before reaching its starting position as described below. The valve housing 14 has at least one lubricant outlet 11 which in the starting position of the valve piston 1 shown in Fig. 1 is situated immediately before the front end of the valve piston facing the dispensing piston. A lubricant passage 11' equipped with a screw plug 21 may serve for filling the distributor element with lubricant.

The working of the distribution element invented is as follows:

In the lubricant interval phase shown in Fig. 1 the pressure operating at the lubricant inlet 6 of the distributor element has been reduced to a residual

pressure. The two return springs 7, 10 are relaxed to the relevant desired and accordingly dimensioned initial tension. The dispensing chamber 3 – after the first fill through a lubricant passage 11' – is filled with lubricant by the preceding lubricating cycle. The transverse bore 2 still connects the dispensing chamber 3 with the metering chamber 4 via the connecting passage 5.

At he beginning of the pressure reduction and lubricating phase a central lubricating pump may build up the lubricant pressure in the main line and in the lubricant inlet 6, 6' to an operating pressure. The valve piston 1 is pushed forward by the operating pressure against the force of the first return spring 7 until it releases the passage 8 to the metering chamber 4 in the valve housing 14 via the connecting passage 5. The lubricant supplied by the lubricant inlet 6 then reaches the metering chamber 4 via the connecting passage 5. The lubricant pressure developing in the metering chamber 4 acts on the dispensing piston 9 which is actuated against the force of the second return spring 10. Simultaneously the check pin section 18 if provided is pulled in. While the metering chamber 4 is filled up on one side of the dispensing piston 9, the dispensing piston displaces on the other side a metered lubricant volume under lubricant pressure from the dispensing chamber 3 against the force of the second return spring 10 to the open lubricant outlet 11. A lubrication manifold (not shown) is connected to the lubricant outlet 11. In the lubricating phase the hydraulic operating pressure of the lubricating pump has a preset minimum value of e.g. 250 bar.

At the completion of the lubricating phase the dispensing piston 9 has displaced the metered lubricant volume from the dispensing chamber 3 to the lubricant outlet 11 (or 11') and, if so equipped, has moved by means of its extension 20 the valve piston 1 to an intermediate position in which the passage 8 to the connecting passage 5 is blocked by the rear part of the valve piston 1.The distributor element remains in this position until a pressure relief valve on the lubricating pump is actuated.

In order to make it possible for the distributor element to reverse, the lubricant line between the lubricating pump and the lubricant inlet 6 of the distributor element is depressurised at the completion of lubrication in a subsequent pressure relief phase. If the first return spring 7 is dimensioned accordingly, a smaller pressure reduction to a desired residual pressure of e.g. 90 bar (compared to 45 bar for the usual distributor elements) is sufficient. The first return spring 7 then pushes the valve piston 1 from the intermediate position first taken up (downward) into the final position shown in Fig. 1 (representing the starting position for the following lubricating cycle). Now the metering chamber 4 is connected again with the dispensing chamber 3 via the connecting passage 5, the released passage 8 and the bore 2.

The second return spring 10 can now transfer lubricant present in the metering chamber 4 to the dispensing chamber 3 and fill it using the above route. When the dispensing piston 9 has reached its upper final position as shown in Fig. 1 through the action of the second return spring 10, the distributor as a whole has returned to its starting position in this lubricating

cycle and a new cycle can begin. The rating of the second return spring 10 independent of the first return spring 7 ensures the desired low minimum operating pressure.

The basic functioning of the embodiments shown in Figures 2 and 2A of a distributor element as per invention is not different from the distributor element shown in the Figures 1 to 1B2. However, where the construction of this distributor element is different is the fact that the supporting body 12 is designed as an elongated cylindrical body coaxial with the two return springs 7 and 10 and that this body accommodates the top part of the first return spring 7. The first return spring 7 is braced at a radially inward projecting flange 24 at the upper end of the supporting body 12 opposite the valve piston 1. Conversely, the second return spring 10 surrounds the cylindrical body 12 with its end that faces the valve piston 1 and is braced on a radially outward projecting bottom flange 23 of the supporting body 12. In this manner the two return springs 7, 10 can be relatively long and have appropriate spring characteristics despite the length of the distributor element remaining the same.

List of reference symbols

1	Valve piston
2	Bore
3	Dispensing chamber
4	Metering chamber
5	Connecting passage
6, 6'	Lubricant inlet, lubricant inlet passage
7	First return spring
8	Passage
9	Dispensing piston
10	Second return spring
11, 11'	Lubricant outlet or passage
12	Supporting body
13	Passage
14	Valve housing
15	Threaded connection
16	Lower sealing body
17	Peripheral seal
18	Check pin section
19	Upper sealing body
20	Extension
21	Screw plug
22	Bearing shoulder
23	Bottom flange
24	Flange